

Chapter 37
Protection, Support, and Movement

I. Integumentary System

A. The outer most covering of animal bodies is called the _____.

- 1. For most species, the integument is a _____ yet pliable barrier against the environment.
- 2. In arthropods, it is a _____ made of chitin and protein.

B. Functions of the Skin

- 1. _____ and protects
- 2. helps control _____.
- 3. produces _____.
- 4. its _____ are essential in detecting stimuli

C. Vertebrate Skin and Its Derivatives

- 1. In vertebrates, the integument consists of _____ and the structures derived from _____ cells, such as scales, feathers, hair, beaks, horn nails, and so forth.
- 2. The skin consists of an _____ and an underlying dermis; a deeper hypodermis anchors the skin to the body.

Figure 37.3
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II. A Look at Human Skin

A. Structure of the Dermis and Epidermis

- 1. Epidermis is a _____ epithelium
 - a. _____ produce keratin, a tough, water insoluble protein that accumulates in the cells.

b. _____ produce melanin pigment that darkens the skin and protects against the sun's rays

- Skin color variations
- albinism

c. The outermost layer consists of flattened _____ cells.

d. _____ cells in the deepest epidermal layer pushing daughter cells upward.

The same _____ give rise to new keratinocytes, hair and oil gland cells.

- _____ could provide ways to remove _____.

o 2. The dermis lies beneath the epidermis

- It dense connective tissue cushions the body _____ everyday stretching and mechanical stresses.
- _____, lymph vessels, and receptors of sensory nerves are embedded in the tissue.

B. Sweat Glands, Oil Glands, and Hairs

- o 1. _____ produce a fluid that is released in response to stress
- o 2. _____ lubricate and soften the skin plus they produce secretions that reduce bacterial populations on the skin
 - Acne
- o 3. Each _____ is a flexible structure rooted in the skin and projecting above it.

III. Types of Skeletons

A. Operating Principles for Skeletons

- 1. Animals move by the action of _____, which need some medium or structural element against which the force of contraction can be applied.
- o 2. There are three main types of skeletons in animals

- a. In _____ skeletons, the force of contraction is applied against internal fluids.
- b. In an _____, the force is against a rigid external body parts, such as shells or plates.
- c. In an _____, the force is applied against rigid internal cartilage or bones

B. Examples from the Invertebrates and Vertebrates

1. _____ use the fluids in their body cavities as resistance against which muscles can act to cause varying degrees of movements.
2. The cartilage in _____ is opaque and hardened with calcium salts
3. _____ skeletons are made primarily of bone.

IV. Characteristics of Bone

A. Functions of Bone

1. Bones interact with muscles to _____ the position of body parts.
2. Bones _____ the skin and soft organs
3. Bones _____ that enclose and protect soft internal organs.
4. Bone tissue acts as a _____ for calcium, phosphorus, and other ions.
5. Parts of some bones are sites of _____ production.

B. Bone Structure

1. There are four types of bones: long, short, flat and irregular.
- 2. Bone is a connective tissue with _____ and collagen fibers distributed throughout a ground substance that is hardened by calcium salts.
 - a. _____ tissue forms the bone's shaft and the outer portion of its two ends.
 - b. _____ around canals that contain blood vessels and nerves.

- The living bone cells reside in the _____ substance.

c. _____ bone tissue has areas of red marrow that produces blood cells; cavities in most mature bones contain yellow marrow, which can be converted to red marrow if blood cell production needs to be increased.

Fig. 37.12 (1)

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3. How Bones Develop

- _____ secrete materials inside the shaft of the cartilage model of long bones
- _____ is deposited; smaller cavities merge to form the larger marrow cavity
- Eventually _____ become trapped within their own secretions and become osteocytes (mature bone cells)

Figure 37.13

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4. Bone Tissue Turnover

- a. _____ is renewed constantly as minerals are deposited and withdrawn during growth and development processes as well as in maintenance of body calcium levels.
- b. _____ maintain _____ levels for the entire body; enzymes from bone cells dissolve bone tissue and release calcium to the interstitial fluid and blood.
- c. _____ (decreased bone density is associated with decreases in osteoblast activity, sex hormone production, exercise and calcium uptake).

Figure 37.14

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V. Human Skeletal Systems

A. The 206 bones of a human are distributed in two portions

- 1. The _____ *skeleton* includes the skull, vertebral column (individual bones separated by cartilaginous intervertebral disks) ribs, and sternum.
-

- 2. The _____ *skeleton* consists of the pectoral girdle with attached upper limbs and the pelvic girdle with lower limbs.

Figure 37.11

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B. Skeletal Joints

1. _____ are areas of contact or near contact between bones
 - a. _____ joints have no gap between the bones and hardly move; flat cranial bones are an example
 - b. _____ joints, such as intervertebral disks, permit slight movement.
 - c. _____ move freely; they are stabilized by ligaments; a capsule of dense connective tissue surrounds the bones of the joint; synovial fluid lubricates the joint.
- 2. Joints are vulnerable to stress
 - a. A _____ is an injury to a ligament. A ligament is a thick tough, fibrous tissue that connects bones together.
 - b. A _____ is an injury to a muscle or tendon.
 - c. In _____, the cartilage at the end of the bone has worn away.
 - d. In _____, the synovial membrane becomes inflamed, the cartilage degenerates, and bone is deposited into the joint.

VI. Skeletal-Muscular Systems

A. How Muscles and bones Interact

- 1. Each skeletal muscle contains several bundles of perhaps hundreds or thousands of muscle cells (=fibers).
 - _____, cordlike straps of connective tissue, attach muscle to bone
 - _____ muscles, often arranged in antagonistic pairs, interact with one another and with bones.
- 2. There are three types of muscle tissues: skeletal, cardiac, and smooth.

VII. Control of Muscle Contraction

A. The Control Pathway

- 1. Skeletal muscles contract in response to signals from the _____ that trigger action potentials along the plasma membrane and into the interior of the muscle cell.
- 2. Eventually, the signal reaches the _____ (E.R.) of the muscle cell, which respond by releasing stored calcium ions.

B. The Control Mechanism

- 1. Under stimulation, the _____ allows a contraction to take place.
- 2. A muscle relaxes when calcium ions are _____ after contraction to be stored in the internal tubes (E.R.)

C. Sources of Energy for Contraction

- 1. During periods of intense muscle activity, _____ is the source of phosphate to remake ATP.
- 2. When muscle action is _____, most of the ATP is provided by aerobic respiration, which is dependent on oxygen supply and number of mitochondria present.
- 3. During _____, anaerobic glycolysis produces low amounts of ATP but also results in an oxygen debt.

VIII. Effects of Exercise and Aging

1. With _____, muscle cells do not increase in number; however they do increase in size and metabolic activity and become resistant to fatigue.

- a. _____, not intense but long in duration, increases the number of mitochondria and blood capillaries
- b. _____ decreases as adult humans age but exercise remains beneficial in improving blood circulation and preventing loss of muscle tissue.